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THE PRICING OF BANK LENDING AND BORROWING: EVIDENCE FROM THE FEDERAL FUNDS MARKET

by

Craig H Furfine

BANK FOR INTERNATIONAL SETTLEMENTS
Monetary and Economic Department
Basle, Switzerland

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Abstract

This paper examines the terms of bank lending and borrowing by exploring pricing in the federal funds market, the market in which financial institutions trade overnight reserves. By exploiting a never-before-used dataset containing detailed information on every Fedwire transfer between financial institutions, interest rates actually paid by institutions in the funds market are calculated. The size of the trading institutions and their relative importance in the funds market are shown to affect the rates charged for overnight borrowing, thereby providing insight into the nature of competition in the federal funds market. Proxies for creditworthiness are also used to estimate the size and nature of very-short-horizon risk premia. Transaction volume and size-of-transaction effects are also explored, highlighting the role of liquidity in interest rate determination. Evidence of relationship banking among banks and an intraday credit market is also found.

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Contents

1. Introduction

Financial institutions play a crucial role in channeling funds from those who save to those who invest. Academic research has therefore given much attention to studying the terms under which such institutions both borrow and lend to fulfill this role as intermediary. With regard to lending, empirical research has documented that the pricing of bank loans generally involves floating rates tied to an underlying index rate (Booth and Chua (1995), Berger and Udell (1990)), collateral requirements (Berger and Udell (1990)) and covenants (Booth and Chua (1995)), and are generally made under commitment (Avery and Berger (1991)). In addition, the literature has shown that the bank's market power (Hannan (1997), Rhoades (1995), Fergus and Notahaft (1995)), its financial standing (Ho and Saunders (1981), Angbazo (1997)), the existence of long-term relationships (Berger and Udell (1995), Petersen and Rajan (1994)), and the nature of regulatory constraints (Duca and Rosenthal (1994), Manage (1990)) affect these terms.[1]

The second half of the role of intermediary, namely the nature and terms of bank borrowing, has been somewhat less studied.[2] There has been empirical support for the role of market power in the pricing of retail certificates of deposit (CDs) (Cooperman, Lee and Lesage (1990, 1991)). The riskiness of financial institutions has also been shown to influence the rates paid by banks in the wholesale CD market (Hannan and Hanweck (1988), Ellis and Flannery (1992)) and quite possibly in the market for subordinate debt (Flannery and Sorescu (1996)).

These analyses of bank lending and borrowing are complicated by at least two difficulties. The first difficulty is largely beyond the control of the researcher. Since most empirical studies of the nature of bank lending and borrowing rely on contract or transaction-level data, the limited availability of such data generally dictates the nature of the empirical work. Popular data sources in the literature include the Federal Reserve's survey of the terms of bank lending (Carey, Prowse, Rea and Udell (1993), Berger and Udell (1990)), the National Survey of Small Business Finances (Berger and Udell (1995), Petersen and Rajan (1994)), the Loan Pricing Corporation's Dealscan database (Carey, Post and Sharpe (1998)), and various filings from the Securities and Exchange Commission (Booth and Chua (1995)).

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[1] The theoretical literature has complimented this literature by deriving motivations for many of these features. For instance, the literature has suggested many theories to explain the common appearance of loan commitments (Thakor (1982), Boot, Thakor and Udell (1987), Kanatas (1987), Morgan (1994)), collateral (Barro (1976), Besanko and Thakor (1987)), fees (Berlin (1987), Thakor and Udell (1987)), and long-term relationships (Diamond (1984), Petersen and Rajan (1995), Boot and Thakor (1994), Sharpe (1990)), Greenbaum, Kanatas and Venezia (1989)). Additional research has described how the financial standing of the bank (Wong (1997), Ho and Saunders (1981)) and the regulatory environment (Madura and Zarruk (1992)) also influence the terms under which banks lend.

[2] Rather than passively lending given an exogenous supply of deposits and capital, banks generally operate by lending to borrowers that seem justified, and then funding these loans where possible (Stigum (1990)). Thus, the ability of banks and other intermediaries to successfully channel funds from savers to investors depends on the nature and terms of bank borrowing.

When using such data, the variables collected or the sample of institutions included generally impose noticeable restrictions on the empirical work being conducted. For instance, such data typically only provide information on the terms of the loan contract. Thus, the research questions that have typically been addressed are those that ask questions regarding the nature of loan contracts. (What effect does the presence of collateral have on loan pricing or loan riskiness? How does the length of a relationship affect the loan interest rate? How does the market power of an institution affect the rate charged on loans or the rate paid on deposits?) These questions have been typically one-sided. That is, they look at the question of bank lending or borrowing from either the borrower's or the lender's perspective, but rarely both.[3] For instance, studies involving data on lending contracts typically do not include variables to measure the creditworthiness of borrowers because such variables are typically not given as part of the underlying survey.[4] Studies on bank borrowing in either local deposit or national CD markets typically only consider variables relating to the financial institution but not the supplier of funds because, again, such data are almost impossible to come by.

The second difficulty in studying banks' lending and borrowing behavior is the complicated nature of financial contracts. As mentioned, collateral requirements, flexible payment schedules, commitments, and other non-price terms make summarizing the details of a loan contract difficult to calculate, much less explain. Empirical research typically summarizes various loan details with dummy variables indicating their presence in the contract, even though economic theory predicts that the relationship between contract features and contract pricing and riskiness are related in non-linear ways. For example, two loan contracts involving collateral may have very different characteristics depending on the degree of collateralization, the security used as collateral, and the terms under which collateral would no longer be required. This typically makes it very difficult to empirically compare the terms of any two given loan contracts.

This paper studies bank lending and borrowing in a way that minimizes these difficulties. To begin, this research examines the pricing decisions of financial institutions active in the federal funds market, the market where financial institutions both buy and sell reserves. These transactions are largely free of the complicating factors present in other loan contracts. In particular, federal funds transactions are by definition uncollateralized.[5] These loans are characterized by a loan extended on one day with principal and interest repaid the following business day. Thus, each of the loans has approximately the same maturity, has maturity equal to its duration, and is free from complicating payment schedules.

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[3] A notable exception to this statement is the extensive efficiency literature, which, by looking at bank profitability, necessarily looks at both the income from lending and the costs from borrowing simultaneously.

[4] The exceptions to this are the various studies examining discrimination in mortgage markets that look closely at borrower characteristics.

[5] Collateralized interbank lending would be considered a repurchase agreement and would not be a part of this database.

Thus, the data in this study isolate the interest rate decision from the other factors that typically complicate loan contracts, giving a clean look at the nature of market pricing.

These data also allow simultaneous examination of the lending and borrowing activities of financial institutions. This is because the federal funds market is where financial institutions lend to one another. As a result, information regarding both the borrower and the lender for each individual transaction is readily available, allowing a more complete analysis of the determination of interest rates.

Due to the nature of these data, the results presented may not generalize to other lending and borrowing markets. In particular, many of the complicated features of loan contracts that are found in other markets may be the optimal bank response to uncertainties that do not exist in an overnight funds market. Nevertheless, evidence is found that the importance of both the lender and the borrower plays a significant role in the pricing of federal funds transactions. Banking relationships, too, seem to play a role, especially when the borrowing institution is small. Perhaps surprisingly, proxies for credit risk detect risk-based pricing, even for overnight claims. Finally, there is evidence of a subtle form of private sector intraday credit, possibly suggesting that the fees charged by the Federal Reserve help influence the market's valuation of these short-term credit extensions.

The remainder of the paper is organized as follows. Section 2 briefly summarizes what is known about pricing in the federal funds market. Section 3 describes the source, strengths, and weaknesses of the transaction-level data. Section 4 presents the empirical findings. Section 5 concludes.

2. Pricing in the market for federal funds

The rate at which financial institutions trade reserves overnight, the federal funds rate, is arguably one of the most watched financial market indicators because, over the business cycle, the funds rate typically indicates the stance of monetary policy (Bernanke and Blinder (1992)). A common misperception is that the Federal Reserve sets the rate at which financial institutions trade reserves through its open market operations. While it is true that Fed action largely determines the aggregate supply of bank reserves, it is the allocation of these reserves within the banking system that determines the rate at which institutions agree to trade. A sampling of rates at which institutions trade federal funds is then averaged (by value) for each day, with the resulting daily average rate being called the "effective" federal funds rate. Current Fed policy uses a target for the effective federal funds rate as an intermediate goal to guide monetary policy, and the Federal Open Market Desk intervenes almost daily in the reserve market to attempt to achieve an effective funds rate for each day close to this announced target. The Fed, however, is not concerned about hitting its target on a daily basis or about determining the pricing of individual federal funds rate transactions. Thus, the cross-sectional

variation in transaction interest rates for a given day and the day-to-day variation in transaction rates are largely determined by the financial institutions trading reserves. It is for this reason that the effective federal funds rate deviates quite noticeably from its target on a daily basis (Spindt and Hoffmeister (1988), Hamilton (1996)).

Most work examining the funds rate has relied on the published effective funds rate and therefore have abstracted from the pricing of individual transactions. For example, observations of the daily effective federal funds rate have been used to test theories of the term structure (Rudebusch (1995)), estimate the Federal Reserve's daily market interventions (Feinman (1993)), or explain anomalies in the behavior of the rate itself (Furfine (1998a), Hamilton (1996), Spindt and Hoffmeister (1988)). In all of these cases, the determination of the effective federal funds rate was derived from a model of a representative financial institution or a representative buyer and seller in the funds market or has taken the daily movements of the funds rate as given exogenously.

To date, the literature has only provided anecdotal evidence regarding the pricing of individual federal funds transactions. Stigum (1990) discusses tiering in the market by which large institutions generally get better terms than smaller institutions. Allen and Saunders (1986) report in a footnote that, based upon conversations with market participants, non-money center banks generally pay between 1/8% and 1/4% above the rate of their money center counterparts.

This paper studies the pricing of individual funds transactions that determine the daily effective federal funds rate. This study takes monetary policy as exogenous. For the sample period, the first quarter of 1998, the target federal funds rate was unchanged at 5.5%. Thus, market forces are driving the variation in the federal funds rate that is found in cross section and over time. The goal, therefore, is to attempt to explain these variations in federal funds rate pricing using empirical measures of commonly mentioned theoretical determinants of pricing.

3. Federal funds transaction data

Both large and small institutions wish to trade in the federal funds market. This is because all institutions face some degree of unexpected inflows and outflows of reserves that they may wish to undo through overnight borrowing or lending. Generally speaking, banks looking to sell funds contact institutions wishing to buy funds and they agree on a mutually acceptable quantity, term (typically overnight), and interest rate.[6] The lender (seller) of funds generally transfers the funds on the day of the sale to the borrower, and the borrower (buyer) of funds returns the borrowed amount, plus the

[6] Brokers may play a role in facilitating this process.

agreed interest to the lender the following business day. These two payments typically occur over Fedwire, the large-value transfer system operated by the Federal Reserve.[7]

These Fedwire payments allow the identification of federal funds transactions analyzed in this study.[8] For business reasons, the Federal Reserve temporarily maintains a record of each payment transaction sent over Fedwire and, from this record, every Fedwire funds transfer made during the first quarter of 1998 was collected. Of the several hundred thousand transactions recorded each day, only a relatively small number are related to the federal funds market. Stigum (1990) argues that federal funds transactions are usually made in round lots of over $1 million. Based on this anecdotal evidence, the sample of transactions was searched, and payments whose amounts were greater than $1 million, ended in five zeros, and had a payment the following business day in the opposite direction in an amount that could reasonably be construed as the initial payment plus interest were identified as federal funds transactions.[9] As interest rates charged vary across transactions, a range of values for valid rates of interest were allowed. For the results below, a window of interest rates was allowed, ranging from 50 basis points below the minimum of the 11 a.m. funds rate, the closing rate, the effective rate, and the Fed's target rate, to 50 basis points above the maximum of these four rates.

Potentially the greatest weakness of this approach to identifying federal funds transactions is that the sending and receiving bank identified in the data need not be the actual parties to the transaction. These banks could be acting either as correspondents or as brokers for the funds transactions of others, or the transactions may represent overnight lending arrangements between non-financial firms operating through different banks. It is also possible that there are transactions struck at a rate outside the selection window, and of course these will be missed.[10]

Despite these caveats, the data present a unique opportunity to examine the determination of interest rates with information available on both the borrower and the lender of funds. Measures of the importance of the buyer and seller can be constructed. Proxies for credit risk for both the borrowing and the lending institution can be used. In addition, the precise duration of the loan is available, as are various measures of banking relationships. Finally, the data allow the exploration of the possible influence of liquidity on interest rates.

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[7] Small federal funds transactions between banks that have correspondent relationships may be arranged through book transfers (accounting entries) and may not require any Fedwire payments.

[8] A more detailed description of the transaction identification process can be found in Furfine (1998b).

[9] Federal funds transactions where market participants return the principal separately from the interest were also identified.

[10] Enlarging the window had a negligible impact on the number of payments identified as federal funds transactions. An alternative selection criterion would be to utilize the Federal Reserve's published values for the high and low value for the funds rate each day. Because these measures are based only on a subset of the overall market, the transactions in the dataset used in this paper contain observations that lie outside the published ranges. Nevertheless, using this alternative approach had a negligible impact on the number of transactions and the results reported, but did add to the number of "outliers" present in the sample, especially those with extraordinarily high rates of interest.

4. Empirical results

The empirical analysis estimates the importance of various factors in determining the interest rates paid for federal funds transactions. The variables chosen have been identified in the literature as possible factors that determine the terms under which banks borrow or lend or have been argued to influence pricing in the funds market in particular.[11]

The dependent variable for the analysis will be the interest rate on the given federal funds transaction. This is measured at an annual rate and has been adjusted for holidays and weekends. To verify that the underlying data are truly federal funds transactions, the weighted average interest rate for each day was calculated and compared with the published effective federal funds rate. The average daily interest rate in the sample is 5.527%, whereas the average effective federal funds rate during the first quarter of 1998 was 5.519%, a difference of less than one basis point. The standard deviation of the sample daily rate is 0.137, slightly below the published value of 0.147. Finally, the two series have a correlation of 0.96. Thus, the sample appears to accurately reflect the federal funds market.

The first determinant of interest rates explored in this research is the relative importance of the two participating institutions. This measure was constructed in three ways. First, the variable Daily_Borrower_Share measures the share of a particular day's aggregate borrowing that the given institution is responsible for. That is, for institution X, this variable would be the amount borrowed by institution X on day Y divided by aggregate borrowing on day Y. The variable Daily_Lender_Share is defined analogously. Alternatively, the variables Aggregate_Borrower_Share and Aggregate_Lender_Share were constructed, measuring the share of total sample borrowing and lending by a given institution. These variables are unique to each institution but do not vary over time. To account for a possible non-linear impact of importance on pricing, the squared levels of the above variables were also included in some specifications. Whereas the previous measures account for the participants' importance to the funds market, pricing might also be related to the relative importance of the financial institution as a whole. Dummy variables denoting five different categories for the size of both the borrower and the lender attempted to account for this possibility. Size is defined as the borrower and lender's total assets as of 31 December 1997.

Another possible determinant of interest rates would be the borrower's credit risk. Although the short-term nature of the loan suggests limited scope for credit risk, the borrower's leverage capital ratio, Borrower_Leverage, was included in the estimation to account for this possibility. As bank capital ratios are strongly inversely proportional to bank size, the dummy variables for bank size can also be

[11] Bank Call Reports were used for the variables that could not be constructed from the transaction database. Some variables were not available for some institutions. In particular, reasonable capital data were not available for foreign institutions, and thus the final sample of 113,805 federal funds transactions is approximately 40% smaller than the full set of transactions that were identified using the process described above.

seen as control variables that allow the leverage measure to better approximate credit risk. The variable Lender_Leverage was also included to explore whether these variables may be serving as proxies for other factors. If the bank's capital ratio were solely capturing the pricing impact of credit risk, the variable Lender_Leverage would probably be insignificant.

The next factor examined is liquidity. Liquidity plays an important role in traditional bank lending. For instance, some have argued that the ability to securitize single family mortgages and sell the securities in deep liquid markets has lowered the cost of securing mortgage financing. Unlike more traditional bank lending, the impact of liquidity on pricing in the funds market is more akin to the role of liquidity in other financial markets such as stock and foreign exchange markets. However, the data here do not allow for a volume-liquidity-pricing study of the kind that has become popular for other markets.[12] This is because the data available on timing relate to the time that the payments were transferred over Fedwire and not the time that the original trade was made. Anywhere from a few minutes to several hours may elapse between the time of a federal funds trade and the flow of money over Fedwire. Nevertheless, one should expect payment times to be positively correlated with trading times simply because the payments necessarily follow the underlying trade. Thus, one might use the timing of payment flows to proxy for market liquidity. To explore this possibility, the analysis includes the variable Liquidity, which measures the share of federal funds value that was delivered over Fedwire during the half-hour period of the given transaction.

Liquidity may also be determined by the size of the transaction. For example, very large loans may have both a limited supply and a limited demand. Dummy variables denoting transactions less than or equal to $10 million, between $10 million and $100 million, and over $100 million were included in the estimation. These categories identify 38.5%, 55.2% and 6.3% of the transactions respectively.

The timing of federal funds payments, in addition to possibly influencing liquidity, has a necessary impact on the intraday reserve balance position of the counterparties involved. That is, a bank that borrows $20 million in the funds market sees its intraday reserve balance rise by $20 million the instant that the payment is processed over Fedwire.[13] Many institutions that are significant buyers of federal funds may be running an intraday overdraft in their reserve account. The timing of the delivery and repayment of federal funds therefore affects the magnitude of a bank's average overdraft. This saves the bank the fee charged by the Federal Reserve for intraday overdrafts (Richards (1994)). Abstracting from a bank's allowable deductible, banks are charged 27 basis points at an annual rate for intraday credit calculated on an average per minute basis. For example, suppose that a bank typically

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[12] Bollerslev, Domowitz and Wang (1997), Peiers (1997) and Huang and Masulis (1996) study this relationship in foreign exchange markets. Stephan and Whaley (1990) and French and Roll (1986) examine the same in equity markets.

[13] Fedwire is a real-time gross settlement system, which means that institutions are debited and credited immediately and with finality the moment the transaction has been processed by the system.

has an average per minute overdraft of $100 million. It would incur a fee of 0.0027x$100,000,000x(1/360) = $750. Suppose the institution delayed repaying a federal funds loan of $20 million for one hour. Since Fedwire operates for 18 hours a day, this would lower its average per minute overdraft to (17x$100m + 1x$80m) / 18 = $98.88m, or in other words by a factor of 1/18 or equivalently 1.5 basis points at an annual rate. Thus, each additional hour that a borrowing bank retains its funds saves it 1.5 basis points.

Since both the borrower and the lender are aware that the timing of payments influences the fees charged by the Federal Reserve, the two counterparties may agree that the interest rate charged may vary depending on the length of time between delivery of the loan and return of the principal. For this reason, the variable Business_Hours_Duration, which measures the number of operating hours that the loan was outstanding, has been included in the analysis. As Fedwire operates from 12:30 a.m. to 6:30 p.m., a loan delivered at 6 p.m. on Friday and returned at 11 a.m. on Monday will have a Business_Hours_Duration value of 11.

Banking relationships may affect the pricing of federal funds transactions. The relationship banking literature finds empirical evidence that small borrowers (presumed to be non-financial firms) benefit by maintaining a relationship with a single bank or a small number of banks (e.g. Petersen and Rajan (1994), Berger and Udell (1995)). In the case of the federal funds market, both the borrower and the lender are financial institutions. Borrowing institutions may establish relationships with particular institutions to establish that they are a good credit risk. By so doing, they may get a more attractive interest rate.

Relationships were measured in two ways. The variable Number_Transactions_Pair is the total number of federal funds transactions between a given borrower and a given lender during the entire sample. As the relationship between the number of transactions and the strength of the underlying relationship may be non-linear, the logarithm of the number of transactions was also used as an explanatory variable. The second proxy for the strength of a relationship is Number_Days_Pair, which measures the number of days that the given borrower has borrowed from the given lender during the 61 days in the sample. The logarithm of this variable, too, is explored. These measures of relationships implicitly assume that the patterns observed during this quarter are indicative of the relationship between the counterparties in the past. As the theories of relationship banking focus on small borrowers, the above measures were interacted with a dummy variable indicating whether the borrowing institution has less than $250 million in assets. Such small financial institutions may have a particularly difficult time conveying to potential lenders that it is a good credit risk, and thus they may particularly benefit from establishing a relationship.

Finally, dummy variables for each of the 61 business days in the sample were included. As documented in Hamilton (1996) and elsewhere, the federal funds rate follows patterns during the two-

week reserve maintenance period as well as around holidays and quarter ends. To isolate the cross-sectional variation in loan pricing, a complete set of dummy variables was used rather than attempting to measure each calendar-related effect separately. To save space, the results for these variables are not reported but are available separately.

Table 1

Definitions of variables used in this study

Daily borrower share	The share of the day's total borrowing of the given borrowing institution.
Daily lender share	The share of the day's total lending of the given lending institution.
Aggregate borrower share	The share of the sample's total borrowing of the given borrowing institution.
Aggregate lender share	The share of the sample's total lending of the given lending institution.
Borrower size	
Less than $250 million	
$250 million - $1 billion	
$1 billion - $10 billion	Indicator variables reflecting the total assets of the borrower on 31 Dec. 1997.
$10 billion - $100 billion	
Over $100 billion	
Lender size	
Less than $250 million	
$250 million - $1 billion	
$1 billion - $10 billion	Indicator variables reflecting the total assets of the lender on 31 Dec. 1997.
$10 billion - $100 billion	
Over $100 billion	
Borrower leverage	The borrowing institution's leverage capital ratio on 31 Dec. 1997.
Lender leverage	The lending institution's leverage capital ratio on 31 Dec. 1997.
Liquidity	The share of the day's total federal funds value that was delivered during the given transaction's half-hour interval.
Business hours duration	The number of Fedwire operating hours between delivery of the federal funds sold and return of the funds with interest.
Transaction size	
Less than $10 million	
$10 - $100 million	Indicator variables reflecting the size of the federal funds transaction.
More than $100 million	
Number of transactions in pair's relationship	The number of transactions involving the sale of funds from the given lender to the given borrower during the entire sample period.
Log (number of transactions in pair's relationship)	The natural log of the number of transactions involving the sale of funds from the given lender to the given borrower during the entire sample period.
Number of days in pair's relationship	The number of days on which funds were sold from the given lender to the given borrower during the entire sample period.
Log (number of days in pair's relationship)	The natural log of the number of days on which funds were sold from the given lender to the given borrower during the entire sample period.

Before turning to the empirical results, Table 1 reviews the definitions of the various variables, and Table 2 presents some summary statistics. As mentioned, the interest rate data replicate the effective funds rate quite well, and it is therefore no surprise that the transaction-level average interest rate is 5.4996%, given that the target funds rate during the sample period was 5.5%. The summary statistics also indicate a fair degree of skewness in the distribution of many variables. As is typically the case in banking, a small number of institutions have characteristics quite different from most other institutions. This sample is no different. Whereas the median observation on aggregate borrowing shares is about 1.3%, the mean is 3.4%. This is reflective of a small number of institutions with significant market share. One institution bought more than 15% of the total funds exchanged over the entire quarter. A similar skewness is apparent in the size of the underlying institutions. The participating institutions have a size ranging from a low of only $9 million in assets to a high of $302 billion. Transaction size and measures of relationships are also skewed. For instance, the mean transaction size is $38 million, but the median is only $18 million. With regard to proxies for relationships, some banks sell funds to a given institution only once during the entire quarter. The median number of transactions for a given pair of institutions is 51, although as many as 1,992 transactions occurred between a given buyer and seller.

Table 2

Summary of transaction data*

	Mean	Standard deviation	Median	Minimum	Maximum
Interest rate	5.4996	0.2407	5.4687	3.5815	13.5000
Daily borrower share	0.0350	0.0500	0.0133	0.0000	0.2012
Daily lender share	0.0212	0.0355	0.0020	0.0000	0.1679
Aggregate borrower share	0.0342	0.0489	0.0127	0.0000	0.1515
Aggregate lender share	0.0206	0.0342	0.0019	0.0000	0.1203
Borrower size ($ millions)	88,000	104,000	37,600	9	302,000
Lender size ($ millions)	53,100	94,000	3,600	9	302,000
Borrower leverage	0.0692	0.0132	0.0693	0.0454	0.2498
Lender leverage	0.0801	0.0283	0.0742	0.0350	0.2498
Liquidity	0.1068	0.0645	0.1018	0.0000	0.2724
Business hours duration	15.3332	2.7832	15.7528	1.1669	34.6558
Transaction size ($ millions)	38.0	69.7	18.0	1	990
Number of transactions in pair's relationship	215.7894	453.9571	51	1	1,992
Number of days in pair's relationship	41.0793	19.2295	47	1	61

* Summary statistics in the federal funds transaction dataset, ranging from 2 January 1998 until 31 March 1998 and containing 113,805 observations over 61 business days.

Table 3 presents the regression output of various specifications for the complete set of 113,805 observations for which the above empirical measures can be constructed. Overall, the variables included in the regression explain about one-third of the cross-sectional variation in interest rates charged. Looking first at the variables that measure the relative importance of the participating institutions, measures of the share of borrowing by the borrower seem to be a significant factor in pricing, particularly when the size of the participating institution is not controlled for. In the circumstances where these variables enter significantly, the relationship between borrowing share and pricing is found to be non-linear, with early levels of borrowing correlated with a decline in price and higher levels of borrowing correlated with a rise in price. This is consistent with market power being influential up to a point, but eventually (at around 7% of the market) additional market share in borrowing actually raises the price paid, consistent with movement along a supply curve. The size of this effect, however, is economically small. In any of the specifications where borrowing shares are statistically significant, the marginal impact of a 1% change in borrowing share is generally less than 1 basis point, and predicts a decline in interest rates of around 0.5 basis points at the median level of borrowing share.

The share of overall lending also reveals a non-linear relationship when institution size is not controlled for. After controlling for size, however, a 1% increase in a bank's lending share tends to be linearly related to a decline in the transaction interest rate of between 0.4 and 0.6 basis points. This result is consistent with any market power impact being dominated by movement along a demand curve.

To some extent, the size and even the significance of the borrowing and lending share variables change when the regressions also control for asset size. Regardless of the specification, however, the economic size of the lending and borrowing shares is dominated by the impact of the participating institutions' asset size. Whereas the variation in bank lending and borrowing shares may be able to explain cross-sectional differences in pricing of up to a few basis points, the magnitude of the impact of bank size on pricing is much larger. For both the lending and the borrowing institution, additional size improves the terms of the transaction. For example, an institution with over $100 billion in assets typically pays 18 to 23 basis points less than an institution with less than $250 million in assets for federal funds borrowed. These very large institutions also typically receive 8 to 11 basis points more than the small institutions when they sell funds. It could be that these very large institutions benefit from a good reputation in the market, and are able to translate this into better terms on their funds transactions. Similarly, this effect may reflect market power in a way not captured by the borrowing and lending shares. That the benefit of being big is greater when borrowing than when lending may reflect a perception that the largest banks are too big to fail, and therefore these borrowers receive even more favorable rates since lenders perceive little or no credit risk.

Table 3

Parameter estimates – all transactions

	Spec. 1	Spec. 2	Spec. 3	Spec. 4	Spec. 5	Spec. 6
Daily borrower share	–0.3105 (0.0611)**			–0.0897 (0.0659)		
Daily borrower share squared	2.3704 (0.3204)**			0.6473 (0.3451)		
Daily lender share	1.5913 (0.0716)**			–0.4240 (0.0937)**		
Daily lender share squared	–11.0132 (0.5729)**			0.1411 (0.6489)		
Aggregate borrower share		–0.7687 (0.0713)**			0.0172 (0.0208)	–0.6130 (0.0794)**
Aggregate borrower share squared		5.5520 (0.4565)**				3.3264 (0.5060)**
Aggregate lender share		1.8788 (0.0815)**			–0.4591 (0.0420)**	–0.6346 (0.0979)**
Aggregate lender share squared		–14.1365 (0.7133)**				0.0652 (0.7579)
Lender size						
Less than $250 million			–0.0854 (0.0028)**	–0.1100 (0.0037)**	–0.1118 (0.0040)**	–0.1153 (0.0041)**
$250 million - $1 billion			–0.0938 (0.0028)**	–0.1184 (0.0037)**	–0.1204 (0.0040)**	–0.1230 (0.0041)**
$1 billion - $10 billion			–0.0670 (0.0026)**	–0.0913 (0.0036)**	–0.0934 (0.0038)**	–0.0956 (0.0040)**
$10 billion - $100 billion			–0.0038 (0.0026)	–0.0214 (0.0030)**	–0.0233 (0.0034)**	–0.0232 (0.0033)**
Over $100 billion			Baseline			
Borrower size						
Less than $250 million			0.0912 (0.0422)*	0.0987 (0.0421)*	0.0993 (0.0422)*	0.0579 (0.0207)**
$250 million - $1 billion			Baseline			
$1 billion - $10 billion			–0.1172 (0.0038)**	–0.1142 (0.0038)**	–0.1146 (0.0037)**	–0.1115 (0.0038)**
$10 billion - $100 billion			–0.1510 (0.0038)**	–0.1467 (0.0039)**	–0.1483 (0.0038)**	–0.1388 (0.0039)**
Over $100 billion			–0.1430 (0.0042)**	–0.1404 (0.0044)**	–0.1419 (0.0043)**	–0.1326 (0.0044)**
Borrower leverage capital ratio	–0.3560 (0.0533)**	–0.2916 (0.0527)**	–0.6098 (0.0585)**	–0.5838 (0.0586)**	–0.5869 (0.0583)**	–0.5548 (0.0580)**
Lender leverage capital ratio	–0.3419 (0.0189)**	–0.3384 (0.0188)**	–0.0521 (0.0182)**	–0.0906 (0.0186)**	–0.0958 (0.0185)**	–0.0878 (0.0187)**
Liquidity	–0.0257 (0.0096)**	–0.0275 (0.0096)**	0.0022 (0.0094)	0.0075 (0.0096)	0.0089 (0.0095)	0.0077 (0.0095)

Note: Robust standard errors in parentheses.

* significant at 5% level; ** significant at 1% level.

Table 3 (cont.)

	Spec. 1	Spec. 2	Spec. 3	Spec. 4	Spec. 5	Spec. 6
Transaction size						
Less than $10 million	–0.0068 (0.0030)*	–0.0089 (0.0029)**	0.0060 (0.0030)*	–0.0004 (0.0031)	0.0000 (0.0031)	–0.0006 (0.0030)
$10 million - $100 million	0.0170 (0.0023)**	0.0149 (0.0023)**	0.0302 (0.0023)**	0.0248 (0.0024)**	0.0252 (0.0023)**	0.0244 (0.0023)**
Over $100 million	Baseline					
Business hours duration	0.0105 (0.0003)**	0.0106 (0.0003)**	0.0080 (0.0004)**	0.0080 (0.0004)**	0.0080 (0.0004)**	0.0081 (0.0004)**
Number of trans. in relationship						0.0000 (0.0000)**
Log (no. of trans. in relationship)			–0.0029 (0.0007)**	–0.0007 (0.0008)	–0.0005 (0.0008)	
Number of days in relationship		–0.0006 (0.0000)**				
Log (no. of days in relationship)	–0.0169 (0.0011)**					
For small borrowers:						
Number of trans. in relationship						*–0.0014 (0.0005)***
Log (no. of trans. in relationship)			*–0.0270 (0.0135)**	*–0.0288 (0.0135)**	*–0.0289 (0.0135)**	
Number of days in relationship		*0.0024 (0.0002)***				
Log (no. of days in relationship)	*0.0377 (0.0023)***					
Observations	113,805	113,805	113,805	113,805	113,805	113,805
R-squared	0.34	0.34	0.36	0.36	0.36	0.36

Due to the importance of bank size, the remaining discussion will focus on the specifications in which size has been controlled for explicitly. In all of these specifications, a 1% increase in the borrowing institution's leverage capital ratio is correlated with a decline in the interest rate charged of approximately 0.6 basis points. This significant effect is consistent with risk-based pricing, since an institution with a higher capital level is presumably less likely to default on its federal funds loan. Part of this measured correlation may be reflective of another influence of bank size. As bank capital ratios are typically inversely related to bank size, the coefficient on the leverage capital ratio may be reflecting the fact that institution size dummies are incomplete proxies for any size-related pricing effect. Evidence that at least part of the coefficient may be reflective of factors other than credit risk is seen in the coefficient on the lender's leverage capital ratio. This variable is significantly different from zero, albeit economically very small. The lender's capital ratio should not affect the credit risk of the transaction, and therefore it seems plausible that the observed coefficient is serving as a further proxy for size.

After controlling for size, the coefficient on liquidity is not statistically different from zero. Thus, the results seem to suggest that market liquidity as measured by the value of payment flow does not help

explain pricing. However, as mentioned, the timing of federal funds payments is not equivalent to the timing of federal funds trades. It may be the case that this error in measurement is sufficient to mask a true liquidity effect, or it may be the case that there is not a price/volume relationship in the funds market as has been found elsewhere. Liquidity may also be a function of transaction size. According to the results here, medium-sized transactions (i.e. those between $10 and $100 million) generally have an interest rate about 2.5 basis points higher than both smaller and larger transactions. This inverted-U-shaped pattern is found in all specifications.

The coefficient on the duration of the federal funds loan provides evidence of an intraday market for funds. For specifications controlling for participant size, each hour of additional duration is correlated with a 0.8 basis point increase in the transaction interest rate. This is very near to half the value of this extra hour in terms of reduced intraday overdraft charges. This evidence suggests that institutions trading funds "split the difference" and share the benefit of delaying the repayment of federal funds loans. An alternative explanation is that the borrowing bank dictates the relationship between the pricing of funds transactions and the duration of the loan, and that the borrowing bank assesses roughly a 0.5 probability of running an overdraft at the time the loan will need to be repaid. Under either hypothesis, such pricing is analogous to an intraday market for funds.

Results for the relationship proxies are consistent with the notion that banking relationships are important in the funds market. This result is especially strong when the borrowing institution is small. Referring to the results from the log specifications, a doubling of the number of transactions between any two counterparties has an economically negligible effect on loan pricing. When the borrowing institution has less than $250 million in assets, a doubling in the number of transactions is correlated with nearly a 3 basis point reduction in the loan interest rate. As the number of transactions between a given small borrower and a given lender ranges from one to 60, such a relationship can have a large economic effect on the prevailing interest rate charged. Analogous specifications, using the number of days for the measure of a relationship (not reported), give a similar finding. A doubling in the number of days during which institutions trade funds is correlated with an interest rate that is lower by 0.6 basis points. When the borrowing institution is a small bank, the effect increases to about 2.3 basis points.

Tables 4, 5, and 6 show the output from the same regressions as in Table 3 except that the sample of transactions has been limited. In Table 4, only transactions less than or equal to $10 million are included. For such transactions, the importance of the participating institution generally seems more important. The coefficients on measures of lending share are noticeably greater in magnitude than those found in the results for the entire sample. Further, the size of the lending institution is correlated with about twice the change in interest rates as was true for the entire sample. Borrower leverage also appears more significant for these small transactions, with a 1% increase in the capital ratio correlated with about a full basis point reduction in the loan interest rate. In contrast to the full sample, bank

relationships seem to affect loan pricing, but only when size is not explicitly accounted for does a differential effect for smaller borrowers appear relevant. This could be because most of these transactions involve relatively small borrowers anyway, so that the distinction of having less than $250 million in assets is not marginally important.

Table 4

Parameter estimates – transactions less than or equal to $10 million

	Spec. 1	Spec. 2	Spec. 3	Spec. 4	Spec. 5	Spec. 6
Daily borrower share	–0.7888 (0.1292)**			0.0371 (0.1412)		
Daily borrower share squared	5.3283 (0.6803)**			0.5477 (0.7363)		
Daily lender share	3.6444 (0.2455)**			–0.9293 (0.3499)**		
Daily lender share squared	–27.3085 (2.5911)**			0.0776 (3.0153)		
Aggregate borrower share		–1.7194 (0.1648)**			0.1151 (0.0387)**	–0.8102 (0.1946)**
Aggregate borrower share squared		11.4925 (1.0444)**				5.2733 (1.2009)**
Aggregate lender share		4.5801 (0.2744)**			–1.2531 (0.1486)**	–1.4745 (0.4066)**
Aggregate lender share squared		–38.8482 (2.9674)**				–0.8430 (3.6111)
Lender size						
Less than $250 million			–0.1594 (0.0080)**	–0.2157 (0.0111)**	–0.2347 (0.0122)**	–0.2362 (0.0125)**
$250 million - $1 billion			–0.1651 (0.0080)**	–0.2208 (0.0112)**	–0.2398 (0.0122)**	–0.2407 (0.0125)**
$1 billion - $10 billion			–0.1330 (0.0085)**	–0.1858 (0.0111)**	–0.2040 (0.0122)**	–0.2035 (0.0124)**
$10 billion - $100 billion			–0.0136 (0.0089)	–0.0529 (0.0095)**	–0.0659 (0.0109)**	–0.0665 (0.0108)**
Over $100 billion			Baseline			
Borrower size						
Less than $250 million			0.0784 (0.0434)	0.0878 (0.0432)*	0.0923 (0.0433)*	0.0738 (0.0213)**
$250 million - $1 billion			Baseline			
$1 billion - $10 billion			–0.0891 (0.0050)**	–0.0809 (0.0053)**	–0.0786 (0.0052)**	–0.0776 (0.0052)**
$10 billion - $100 billion			–0.1260 (0.0053)**	–0.1192 (0.0058)**	–0.1181 (0.0054)**	–0.1108 (0.0060)**
Over $100 billion			–0.1200 (0.0062)**	–0.1212 (0.0071)**	–0.1200 (0.0067)**	–0.1120 (0.0072)**
Borrower leverage capital ratio	–0.7628 (0.0915)**	–0.7778 (0.0951)**	–1.0636 (0.1006)**	–0.9997 (0.1010)**	–0.9929 (0.1002)**	–1.0297 (0.1017)**
Lender leverage capital ratio	–0.4218 (0.0386)**	–0.4139 (0.0381)**	0.0674 (0.0358)	0.0340 (0.0361)	0.0223 (0.0362)	0.0263 (0.0361)
Liquidity	0.0227 (0.0188)	0.0119 (0.0189)	0.0448 (0.0183)*	0.0422 (0.0184)*	0.0430 (0.0182)*	0.0403 (0.0182)*

Note: Robust standard errors in parentheses.

* Significant at 5% level; ** significant at 1% level.

Table 4 (cont.)

	Spec. 1	**Spec. 2**	**Spec. 3**	**Spec. 4**	**Spec. 5**	**Spec. 6**
Transaction size						
Less than $10 million			Baseline			
$10 million - $100 million			Not applicable			
Over $100 million			Not applicable			
Business hours duration	0.0150 (0.0006)**	0.0151 (0.0006)**	0.0097 (0.0007)**	0.0096 (0.0007)**	0.0096 (0.0007)**	0.0096 (0.0007)**
Number of trans. in relationship						0.0000 (0.0000)**
Log (no. of trans. in relationship)			–0.0080 (0.0019)**	–0.0051 (0.0020)**	–0.0037 (0.0020)	
Number of days in relationship		–0.0010 (0.0001)**				
Log (no. of days in relationship)	–0.0296 (0.0023)**					
For small borrowers:						
Number of trans. in relationship						*–0.0001 (0.0006)*
Log (no. of trans. in relationship)			*–0.0062 (0.0144)*	*–0.0082 (0.0144)*	*–0.0091 (0.0144)*	
Number of days in relationship		*0.0031 (0.0002)***				
Log (no. of days in relationship)	*0.0420 (0.0027)***					
Observations	43,782	43,782	43,782	43,782	43,782	43,782
R-squared	0.28	0.28	0.31	0.32	0.32	0.32

Table 5 gives the results when transactions involving the largest institutions are omitted. Overall, the explanatory variables do a much better job in explaining the cross-sectional variation in interest rates for this sample. The R^2 for this sample is over 0.5 compared to roughly one-third for the full sample and all other sub-samples considered. The results for borrowing share are qualitatively and quantitatively similar to those found for the sample of smaller transactions. For the lending share variables, evidence of a non-linear relationship appears. In particular, the results suggest that market power may influence pricing at low levels of market power before the demand curve effect begins to dominate. For levels of lending market share below 3%, a 1% higher market share correlates with higher interest rates of around 1 basis point. Unlike the full sample, the measure of liquidity appears significantly, yet is small in magnitude. What is somewhat striking about this sub-sample of transactions is that the importance of relationships appears not to be muted by the removal of the largest institutions.[14] That is, relationships with institutions are valuable to small borrowers even if those relationships are not with the biggest banks.

[14] These effects are statistically significant at an 8% level.

Table 5

Parameter estimates – transactions not involving a large institution

	Spec. 1	Spec. 2	Spec. 3	Spec. 4	Spec. 5	Spec. 6
Daily borrower share	–2.1744 (0.1146)**			–0.5241 (0.1318)**		
Daily borrower share squared	20.6508 (1.7315)**			4.2061 (1.9212)*		
Daily lender share	3.2983 (0.1865)**			0.9876 (0.2039)**		
Daily lender share squared	–35.2470 (2.0387)**			–13.8331 (2.1218)**		
Aggregate borrower share		–2.6922 (0.0923)**			–0.2820 (0.0531)**	–0.9583 (0.1064)**
Aggregate borrower share squared		26.7440 (1.2043)**				8.0928 (1.4549)**
Aggregate lender share		4.9426 (0.2275)**			–0.1325 (0.0642)*	1.3971 (0.2531)**
Aggregate lender share squared		–60.6154 (2.9905)**				–21.0392 (3.1791)**
Lender size						
Less than $250 million			–0.0666 (0.0022)**	–0.0658 (0.0026)**	–0.0719 (0.0025)**	–0.0692 (0.0027)**
$250 million - $1 billion			–0.0723 (0.0022)**	–0.0718 (0.0026)**	–0.0777 (0.0024)**	–0.0747 (0.0027)**
$1 billion - $10 billion			–0.0565 (0.0021)**	–0.0554 (0.0026)**	–0.0609 (0.0024)**	–0.0560 (0.0027)**
$10 billion - $100 billion			Baseline			
Over $100 billion			Not applicable			
Borrower size						
Less than $250 million			Baseline			
$250 million - $1 billion			–0.0788 (0.0458)	–0.0819 (0.0458)	–0.0850 (0.0457)	–0.0537 (0.0216)*
$1 billion - $10 billion			–0.2060 (0.0459)**	–0.2065 (0.0460)**	–0.2097 (0.0459)**	–0.1770 (0.0216)**
$10 billion - $100 billion			–0.2382 (0.0457)**	–0.2344 (0.0458)**	–0.2382 (0.0457)**	–0.2024 (0.0215)**
Over $100 billion			Not applicable			
Borrower leverage capital ratio	–0.4233 (0.0584)**	–0.4445 (0.0592)**	–0.6326 (0.0608)**	–0.6397 (0.0610)**	–0.6229 (0.0608)**	–0.6312 (0.0602)**
Lender leverage capital ratio	–0.2493 (0.0156)**	–0.2322 (0.0154)**	–0.0900 (0.0147)**	–0.0921 (0.0150)**	–0.0962 (0.0147)**	–0.0901 (0.0148)**
Liquidity	0.0120 (0.0085)	0.0051 (0.0085)	0.0175 (0.0080)*	0.0176 (0.0082)*	0.0182 (0.0081)*	0.0179 (0.0081)*

Note: Robust standard errors in parentheses.

* Significant at 5% level; ** significant at 1% level.

Table 5 (cont.)

	Spec. 1	**Spec. 2**	**Spec. 3**	**Spec. 4**	**Spec. 5**	**Spec. 6**
Transaction size						
Less than $10 million	–0.0143 (0.0032)**	–0.0141 (0.0032)**	–0.0079 (0.0031)*	–0.0102 (0.0033)**	–0.0106 (0.0033)**	–0.0084 (0.0034)*
$10 million - $100 million	0.0125 (0.0028)**	0.0099 (0.0028)**	0.0296 (0.0026)**	0.0260 (0.0027)**	0.0268 (0.0028)**	0.0270 (0.0028)**
Over $100 billion			Baseline			
Business hours duration	0.0126 (0.0003)**	0.0124 (0.0003)**	0.0093 (0.0003)**	0.0094 (0.0003)**	0.0094 (0.0003)**	0.0093 (0.0003)**
Number of trans. in relationship						0.0000 (0.0000)**
Log (no. of trans. in relationship)			–0.0083 (0.0008)**	–0.0073 (0.0009)**	–0.0063 (0.0009)**	
Number of days in relationship		–0.0007 (0.0000)**				
Log (no. of days in relationship)	–0.0160 (0.0010)**					
For small borrowers:						
Number of trans. in relationship						*–0.0014 (0.0005)**
Log (no. of trans. in relationship)			*–0.0249 (0.0148)*	*–0.0252 (0.0148)*	*–0.0263 (0.0147)*	
Number of days in relationship		*0.0024 (0.0002)***				
Log (no. of days in relationship)	*0.0348 (0.0022)***					
Observations	70,010	70,010	70,010	70,010	70,010	70,010
R-squared	0.50	0.50	0.53	0.53	0.53	0.53

Table 6 explores whether pricing in the federal funds market is noticeably different on reserve settlement days. As described in Furfine (1998a), Hamilton (1996) and Spindt and Hoffmeister (1988), such days are also those on which the effective funds rate tends to be higher. The results in Table 6 suggest, however, that no major differences in how transactions are priced can be found on settlement days. In most specifications, the lending share of the participating bank is a less significant determinant of pricing, although in economic terms the differences are slight. Relative to the full sample, the size of the lender appears less important but the size of the borrower seems more important. Borrower leverage, too, seems to be a less significant determinant of pricing, while duration of the transaction seems to be marginally more important.

Given that only small changes are uncovered in the estimated impact of the economic variables on pricing on settlement days, there must be an alternative explanation for the higher rates of interest on such days. That is, if the pricing of a given transaction does not significantly change on settlement days, the transactions themselves must change. In particular, the data show a noticeable difference in the distribution of participants in the market on settlement days. In particular, the two largest categories of banks are more active sellers on settlement days, and this, combined with the relatively

higher interest rates that such institutions get when selling funds, can produce a noticeably higher value-weighted average interest rate on these days.

Table 6

Parameter estimates – all transactions on reserve settlement days

	Spec. 1	Spec. 2	Spec. 3	Spec. 4	Spec. 5	Spec. 6
Daily borrower share	–0.8630 (0.1371)**			–0.4117 (0.1501)**		
Daily borrower share squared	5.4319 (0.8215)**			2.1322 (0.8763)*		
Daily lender share	0.4764 (0.1171)**			–0.8835 (0.1650)**		
Daily lender share squared	–2.1341 (0.8558)*			4.9613 (0.9707)**		
Aggregate borrower share		–1.2342 (0.1548)**			–0.0333 (0.0418)	–0.6604 (0.1595)**
Aggregate borrower share squared		7.9591 (0.9588)**				3.5318 (0.9903)**
Aggregate lender share		0.8526 (0.1420)**			–0.1388 (0.0817)	–0.5707 (0.2012)**
Aggregate lender share squared		–5.2509 (1.2132)**				3.0258 (1.3951)*
Lender size						
Less than $250 million			0.0134 (0.0035)**	0.0130 (0.0035)**	0.0134 (0.0035)**	0.0130 (0.0034)**
$250 million - $1 billion			Baseline			
$1 billion - $10 billion			0.0254 (0.0040)**	0.0269 (0.0041)**	0.0256 (0.0041)**	0.0246 (0.0041)**
$10 billion - $100 billion			0.0622 (0.0052)**	0.0749 (0.0059)**	0.0648 (0.0055)**	0.0705 (0.0062)**
Over $100 billion			0.0571 (0.0056)**	0.0806 (0.0079)**	0.0647 (0.0080)**	0.0726 (0.0085)**
Borrower size						
Less than $250 million			0.0777 (0.0439)	0.0898 (0.0442)*	0.0814 (0.0440)	0.0327 (0.0307)
$250 million - $1 billion			Baseline			
$1 billion - $10 billion			–0.1401 (0.0108)**	–0.1349 (0.0108)**	–0.1391 (0.0109)**	–0.1333 (0.0108)**
$10 billion - $100 billion			–0.1873 (0.0105)**	–0.1770 (0.0107)**	–0.1859 (0.0105)**	–0.1722 (0.0107)**
Over $100 billion			–0.1841 (0.0110)**	–0.1725 (0.0113)**	–0.1814 (0.0112)**	–0.1675 (0.0113)**
Borrower leverage capital ratio	–0.1629 (0.1200)	–0.0938 (0.1209)	–0.5109 (0.1256)**	–0.4868 (0.1265)**	–0.5161 (0.1259)**	–0.4768 (0.1277)**
Lender leverage capital ratio	–0.3268 (0.0483)**	–0.2894 (0.0484)**	–0.0629 (0.0469)	–0.1031 (0.0478)*	–0.0761 (0.0474)	–0.0796 (0.0479)
Liquidity	0.0510 (0.0189)**	0.0497 (0.0190)**	0.0594 (0.0184)**	0.0650 (0.0184)**	0.0620 (0.0185)**	0.0619 (0.0184)**

Note: Robust standard errors in parentheses.

* Significant at 5% level; ** significant at 1% level.

Table 6 (cont.)

	Spec. 1	Spec. 2	Spec. 3	Spec. 4	Spec. 5	Spec. 6
Transaction size						
Less than $10 million	–0.0235 (0.0066)**	–0.0232 (0.0067)**	–0.0175 (0.0065)**	–0.0210 (0.0067)**	–0.0200 (0.0068)**	–0.0202 (0.0068)**
$10 million - $100 million	0.0116 (0.0059)	0.0108 (0.0060)	0.0209 (0.0058)**	0.0184 (0.0060)**	0.0186 (0.0060)**	0.0185 (0.0061)**
Over $100 million	Baseline					
Business hours duration	0.0124 (0.0007)**	0.0124 (0.0007)**	0.0097 (0.0007)**	0.0099 (0.0007)**	0.0098 (0.0007)**	0.0100 (0.0007)**
Number of trans. in relationship						0.0000 (0.0000)**
Log (no. of trans. in relationship)			0.0024 (0.0014)	0.0064 (0.0017)**	0.0036 (0.0016)*	
Number of days in relationship		–0.0002 (0.0001)**				
Log (no. of days in relationship)	–0.0052 (0.0023)*					
For small borrowers:						
Number of trans. in relationship						*–0.0015 (0.0007)**
Log (no. of trans. in relationship)			*–0.0314 (0.0128)**	*–0.0344 (0.0129)***	*–0.0322 (0.0128)**	
Number of days in relationship		*0.0021 (0.0004)***				
Log (no. of days in relationship)	*0.0350 (0.0058)***					
Observations	11,241	11,241	11,241	11,241	11,241	11,241
R-squared	0.31	0.31	0.35	0.36	0.35	0.36

5. Conclusions

The analysis of this paper demonstrates that individual loan pricing decisions are important, even when the loan lasts only overnight and is to another financial institution. The evidence suggests that the relative importance of the participating institution, in terms of both market share and asset size, is related strongly to federal funds interest rates. Risk-based pricing was discovered, as was pricing behavior effectively equivalent to an intraday interbank loan market. Finally, evidence of relationship banking was found to be especially strong when a borrowing bank is relatively small.

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